Dust from the Krakatoa Eruption of 1883.

By Joseph Wharton, Philadelphia.

The splendid roseate glows which in the winter of 1883–4 were visible in the western sky after sunset and in the eastern sky before sunrise, gave rise to many conjectures, but apparently to almost no experiments. A few persons believed those glows to be sunlight reflected from the under surface of a stratum of fine solid particles suspended at a great height in the atmosphere; some thought with me that those particles might be volcanic dust which had floated to us from the eruption at Krakatoa, but, as no one offered any proof of this, I attempted on the morning of January 20, 1884, to demonstrate it. Six miles northward from the centre of Philadelphia, where I reside, a light and fine snow was then gently falling in an almost calm atmosphere, presumably from a high altitude. Of that snow, while it was yet falling, I collected about a gallon by skimming it carefully with my hands from a considerable surface in a field a hundred yards to windward of my house and a quarter-mile from the nearest windward building.

This very clean new-fallen snow I melted under cover in the porcelain bowl it was gathered in, and was at first unable to detect any sediment; after maintaining for several minutes a gentle rotatory movement of the bowl in order to bring into its deepest part any solid matter which might be present, I poured off most of the water and evaporated the remainder. A minute quantity of fine dust was then discerned by the tiny vitreous reflections which it gave in the sunlight. My practice in chemical analysis, and therefore in weighing small quantities, affords some justification for the estimate that the total weight of this dust was less than one-hundredth of a grain.

Under the microscope, where it was immediately placed, this dust showed the characteristics of volcanic glass; it consisted in part of irregular, flattish, blobby fragments, mostly transparent and showing no trace of crystalline structure, in part of transparent filaments more or less contorted, sometimes attached together in wisps, and mostly sprinkled with minute glass particles. The filaments of glass had about the same diameter as single filaments of silk placed on the microscope slide for comparison with them.

Having microscopically examined the dust again and again, I ignited it upon platinum to destroy any organic matter which might be present, and thereafter found the filaments, the flat plates, and the amorphous accretions of glass quite unchanged.

No pyroxene, augite, or magnetite, such as have elsewhere been observed in volcanic dust, was present; it may be assumed that, if at first mingled with the glass, those heavier minerals had been dropped during the long voyage of more than ten thousand miles of space and more than four months of time.

The capacity of fine volcanic glass to float in the air to considerable distances being a well-established phenomenon, my examination claims no greater novelty or interest than what may be due to the actual finding of such glass at so great distance from the point of its ejection.

In this case two separate ejections seem to be indicated, for on several evenings I observed a second and fainter glow after the original and stronger glow had entirely disappeared. A higher stratum of finer particles doubtless reflected the sunlight from the greater altitude after the sun had set at the lower elevation of the principal dust stratum.

Early in February, 1884, the ship *J. E. Ridgeway* arrived at Philadelphia from Manila by the Strait of Sunda. On February 12, I visited that ship, and read on her log-book that at 10 P.M., October 27, 1883, in south latitude 7° 57′ and east longitude 100° 54′ (about five hundred miles W. S. W. from Krakatoa), she encountered a vast field of floating pumice, through which she sailed until 7 A.M., October 29. So abundant was this pumice that the ship's speed was reduced from nine knots when she entered it to two knots at 6 P.M., October 28; several hours after that time her speed gradually increased, as the pumice became less dense, from two knots to eight, and finally, when she cleared it, to her normal nine knots. No volcanic ash had fallen upon the ship, as she arrived too late upon the scene.

Some of this pumice I took directly from the hands of the mate and steward, who had collected it from the sea and had kept it in their private lockers. It can scarcely be doubted that this pumice was ejected from Krakatoa.

Now, on placing under the microscope small crumbs of that pumice and filaments picked out from its cavities, I recognized just such transparent flattish scraps and ragged accretions as were

among the dust found in the snow-fall of January 20, while the filaments, though less varied and interesting than those then collected, were quite similar in character, even to the tiny glass particles sprinkled upon them.

A minor point of resemblance was that the yellow color of one little vesicular mass in the dust caught January 20 was fairly matched by a slight streak of similar color in the pumice.

In March, 1884, I collected dust from the steel works at South Bethlehem, Pa., and also dust from a blast furnace there, in order to compare them with the dust found in the snow and with the filaments and crumbs of pumice from the ship *J. E. Ridgeway*.

After separating from these dusts the large proportion which was attracted by the magnet, the remnant showed in each case many vitreous particles; that from the iron furnace largely spheroidal or globular, with a few filaments; that from the steel works partly minute rounded particles, but containing many filaments of great tenuity. Neither contained such clear vitreous plates and aggregations as abounded in the snow-dust, while the filaments in both cases were of dark color, and smooth, straight form, distinctly different from the colorless and frequently contorted filaments of the snow-dust.

It is difficult to resist the conclusions (1) that the vitreous dust found in the snow-fall of January 20, 1884, was not derived from iron or steel furnaces, (2) that it was of similar origin to the floating pumice found by the ship *J. E. Ridgeway*, (3) that it was ejected by the huge volcanic explosions of Krakatoa.

Den Forschern.

Von Dr. Hermann Rollett (Baden bei Wien).*

Welch' frischhinwogende Bewegung hast
Du aufgestört, die Alles rings erfasst,
Du Wort *Darwin's*, das längst lag auf den Zungen,
Doch auszusprechen Keinem war gelungen:
Dass sich—nach Luftart, Nahrung, anderm Leben—
Die Organismen "anzupassen" streben;
Dass "Aenderungen" sich dadurch gestalten,
Die durch "Vererbung" fest sich forterhalten;

*Als Gruss aus der Ferne gewidmet zur glorreichen, am 22. bis 26. Mai 1893 stattfindenden Jubiläumsfeier der American Philosophical Society in Philadelphia.